TB Wood's

BERGES

Operating Instructions

ACM-D2
Serial Data Transmission
BERGES Protocol

Translation based on document D2STDDI.DOC, revision 31.07.98.

1 Introduction

The D2A-STD software range supports independent serial data protocols over the serial interface. The inverter recognises the protocol automatically and so the user does not need to configure the protocol used.

1.1 BERGES protocol

This protocol uses a block process with FEC (forward error correction) for error handling, thus enabling “secure” data transmission. Thanks to the compact structure of the data frame used and the simple protocol structure, the highest data transfer rate can be achieved with this protocol. Refer to the corresponding documents for further information about the BERGES protocol. The following text describes this protocol.

1.2 Extended BERGES protocol

This has the same structure as the BERGES protocol, with the exception that inverter addresses up to the value 127 are accepted.

1.3 ISO protocol

Refer to the corresponding documents for further information about the ISO protocol.

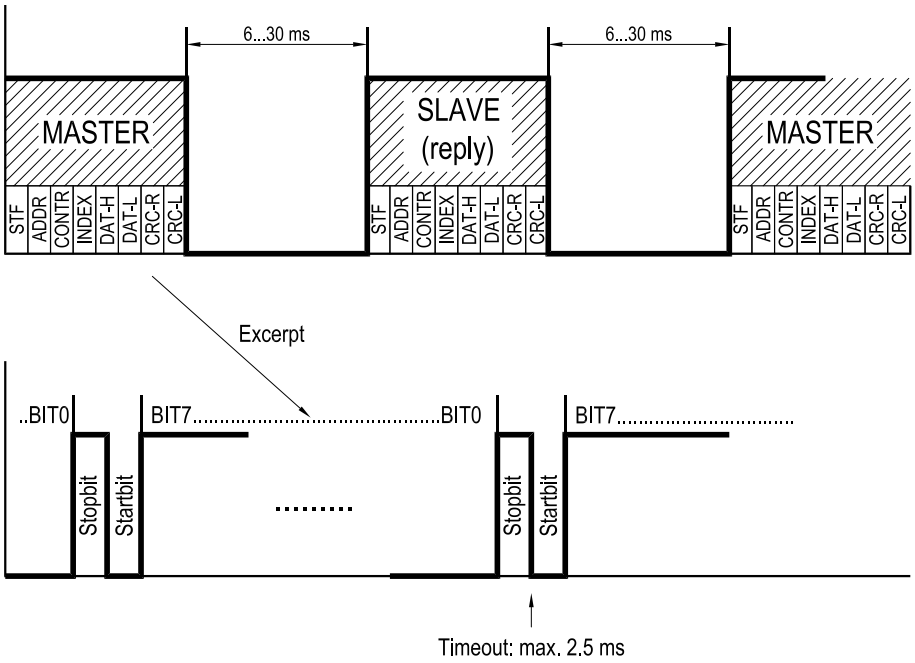
2 General information about the BERGES protocol

A master/slave process is used. The master device is defined by its address (addr. = 0). All other devices are slave and so no arbitration mechanism is provided. Only the master device is allowed to start a transfer or polling. Slaves can communicate with one another via the master only (i.e.: during every transfer, the master must appear either as the sender or the recipient).

It is possible to write all inverters (slaves) simultaneously from the master (address = 0) with the broadcast function (Write-Only). Thus, when changing Fmax to 60 Hz, for example, it is not necessary to singly address all inverters (slaves) with the corresponding address (SIO address set on the inverter) and the broadcast function can be used instead (Write-Only). The SIO addresses (SIO address > 0) of the inverters (slaves) cannot be adjusted with the broadcast function, except in the case of an inverter that has not yet been addressed (SIO address = 0) on the RS485 bus, which can be set to a still free address with the broadcast function. If an inverter is set to an address > 15 (extended BERGES protocol (frame start byte = AAH)), the address can also be adjusted with the BERGES protocol (frame start byte = 99H) via the broadcast function.

The data is secured with a BLOCK CODE (line and column parities). In the receiving device, an FEC (forward error correction) process is used for error correction, and so simple errors can be corrected. Error bursts are also corrected provided they concern only one data byte. The data block affected is rejected if multiple errors are detected (this is not reported back!).

TRANSFER: 1 start bit, 8 data bits, 1 stop bit, 9600 Baud
e.g. Mode COM2: 9600, n, 8, 1.



Data transfer times

3 Frame structure of the BERGES protocol (frame start byte = 99H)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7

Byte	Designation	Description
BYTE0	STF	**Frame start byte:** by virtue of this byte, the recipient recognises the required protocol and indicates the start of a data frame
BYTE1	ADDR	**Address byte:** SA: BIT7...BIT4: Sender´s address EA: BIT3...BIT0: Recipient´s address Slave addresses: 1...15 Slave address 0: no serial transfer
BYTE2	CONTR	**Control byte**
BYTE3	INDEX	**Index byte**
BYTE4	DAT-H	**Data byte, high byte**
BYTE5	DAT-L	**Data byte, low byte**
BYTE6	CRC-R	**Column parity** (even): the frame start byte (BYTE0) is not secured as well
BYTE7	CRC-L	**Line parity** (even): CRC-R is also taken into account

4 Frame structure of the extended BERGES protocol (frame start byte = AAH)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7

Byte	Designation	Description
BYTE0	STF	**Frame start byte:** by virtue of this byte, the recipient recognises the required protocol and indicates the start of a data frame
BYTE1	ADDR	**Address byte:** SA: BIT7 = 1 (to the master): Sender´s address EA: BIT7 = 0 (to the slave): Recipient´s address BIT6...BIT0 = Slave address Slave addresses: 1...127 Slave address 0: no serial transfer
BYTE2	CONTR	**Control byte**
BYTE3	INDEX	**Index byte**
BYTE4	DAT-H	**Data byte, high byte**
BYTE5	DAT-L	**Data byte, low byte**
BYTE6	CRC-R	**Column parity** (even): the frame start byte (BYTE0) is not secured as well
BYTE7	CRC-L	**Line parity** (even): CRC-R is also taken into account

5 Protocol parameter manipulation

5.1 CONTR byte

The Contr byte serves to “switch over” the PROTOCOL for special applications, for polling and for protocol control (Write/Read). It is handled as follows:

Contr byte = 00H Polling

The slave addressed responds with the STATUS WORD (index 38) or with the ERROR CODE (index 37) if an error has occurred. Consequently, the polling block is also suitable for querying the inverter´s status.

Contr byte, BIT7 Reply flag (read flag)

The master requests a reply from the slave when a BIT7 is set. The slave replies only if explicitly requested to do so (BIT7 set). If a CONVERTER ERROR has occurred, it replies in any case with the ERROR CODE (index 37). The keyboard (index 2F to 32), which responds with the display content in any case, is an exception to this. If a slave responds with the BIT7 set, a protocol error is thus signalled to the master (e.g. a special application is not supported, range violations, attempt to write to read-only index, etc.).

Contr byte, BIT0 change parameter (write flag)

When set, BIT0 causes the slave to accept a parameter. A range check takes place in the slave. In the event of a range violation, an error flag is set (BIT7 in the next reply) and, depending on the index, the corresponding limit is accepted or the value is rejected.

Contr byte, BIT1...BIT6 = 0 ACM-D2

1	x	x	x	x	x	x	1
READ	ACM-D2 BIT6...BIT1 = 0						**WRITE**
BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0

5.2 INDEX byte

The index byte serves to specify the required parameter and the associated reply parameter (if a reply is requested).

5.3 Data format (data byte DAT-H, DAT-L)

Data format: 16-bit integer unsigned (unless otherwise specified).

DAT-H (high byte)								**DAT-L** (low byte)							
BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0

6 Index list ACM-D2 (D2A-STD-014 software)

Index	Parameter	Description	Inverter value	Index value	Default
00 [1]	3	Maximum frequency	6...650 Hz	600...65000	5000
01	4	Minimum frequency	0...Fmax	0...Index 00	0
02	5	Startup time, ramp 1	0.05...1000 sec.	Remark 1 (page 7)	
03	6	Slow-down time, ramp 1	0.05...1000 sec.	Remark 1 (page 7)	
04	E	Startup time, ramp 2	0.05...1000 sec.	Remark 1 (page 7)	
05	F	Slow-down time, ramp 2	0.05...1000 sec.	Remark 1 (page 7)	
06 [1]	7	V/f ratio	30...650 Hz	3000...65000	5000
07 [1]	8	BOOST	0...40%	0...400	50
08 [1]	8+	Dynamic BOOST	0...50%	0...50	0
09 [1]	8-	V/f reduction Braking phase	0...20%	100...80 Remark 2 (page 7)	80
0A [1]	9	Static torque	0...25 sec.	0...250 251 → continuous static torque	20
0B [1]	t	DC brake activation time	0...20 sec.	0...200	0
0C [1]	DC	DC brake intensity	0...50%	0...50	15
0D [1]	U	Frequency threshold FX1	0...Fmax	0...Fmax	5000
0E [1]	u	Frequency threshold FX2	0...Fmax	0...Fmax	1000
0F	REL	Config. relay output	-11...0...+11	Remark 3 (page 7)	
10	OC1	Config. open-collector	-11...0...+11	Remark 3 (page 7)	
11	OC2	Config. open-collector	-11...0...+11	Remark 3 (page 7)	
12	S	Activ. current threshold, external	0 = Loc/1 = Rem	Remark 4 (page 8)	
13	BrLim	Software braking protection	0...15	0...15	0
14	DIS	Display configuration	0, 1, 2, 4, 6, 8 (0...5)	0...5	0
15 [1]	Fm	Final analog output value	5...650 Hz	500...65000	5000

Index	Parameter	Description	Inverter value	Index value	Default
16	REF	Setpoint input selection	1...5	0...4	0
17	FILTER	Digital filter	0...6	0...6	3
18	S - INT	Handling of motor current limit	0...4	0...4	0
19 [1]	S	Limit: motor current	0...200%	0...255 Remark 5 (page 8)	150
1A [1]	HYS	Hysteresis: current limit	2...30%	3...39 Remark 6 (page 8)	4
1B [1]	DY	Deceleration time: limit handling	0...20 sec.	0...200	50
1C [1]	FFIX	Fixed frequency 1	0...650 Hz	0...65000	500
1D [1]	FFIX	Fixed frequency 2	0...650 Hz	0...65000	1000
1E [1]	FFIX	Fixed frequency 3	0...650 Hz	0...65000	2000
1F	FFIX	Fixed-frequency rotation direction		Remark 7 (page 9)	00000000
20	A. out	Config. analog output	0...2	0...2	0
21	CLIP	Clipping	0...15	0...15	2
22 [1]	Fk	Setpoint input scaling	40...100%	0...60 Remark 8 (page 9)	0
23	JOG	JOG mode and motor potentiometer	OFF, ON, Mpt1, Mpt2 (0...3)	0...3	0
24	AO	Fine tuning: output frequency	0...100%	0...100	0
25	FFB	Profile of V/f characteristic	0 = linear/1 = quadrat.	0...1	0
26 [1]	FFB	BOOST form factor	0...255	0...255	196
27 [1]	MOD	Modulation depth	0...255	0...255	ACM230V 230 ACM400V 245
28	R_Sel	Activation of second ramp set	0...4	0...4	0
29 [1]		Off LEVELS		Remark 9a (page 9)	11111111
2A [1]		Active LEVELS		Remark 9b (page 9)	00000000
2B	SUB XPAR	Extended parameterisation	ON, OFF	Remark 10 (page 10)	10111010
2C [1]	1	Output frequency display	0...Fmax	Remark 11 (page 10)	
2D	2	Motor voltage display	0...100...x%	Remark 12 (page 10)	Read value
2E	I	Motor current display	0...200%	Remark 13 (page 11)	Read value
2F [1]...32		Keyboard & display Local/Remote		Remark 14 (page 11)	
33	SIO	SIO address	0...15 (BERGES protocol) 0...127 (extended BERGES protocol)	A valid value is stored in non-volatile memory; the values is ignored in the event of a range violation.	
34	Software	Software version		Remark 15 (page 12)	Read value
35 [1]		SIO Timeout		Remark 16 (page 12)	
36		Reserved			
37		Error code		Remark 17 (page 12)	Read value
38		Status word		Remark 18 (page 13)	Read value
39 [1]		Frequency setpoint	0...Fmax	Remark 19 (page 14)	
3A		Control word		Remark 20 (page 14)	
3B		F Local	Value for internal works diagnosis		Read value
3C		Reserved			
3D		Reserved			

Index	Parameter	Description	Inverter value	Index value	Default
3E		Reserved			
3F		Reserved			
40 [1]	a	Locking freq. 1, low limit	0...650 Hz	0...Index 41	0
41 [1]	A	Locking freq. 1, high limit	0...650 Hz	Index 40...Index 42	0
42 [1]	b	Locking freq. 2, low limit	0...650 Hz	Index 41...Index 43	0
43 [1]	B	Locking freq. 2, high limit	0...650 Hz	Index 42...Index 44	0
44 [1]	c	Locking freq. 3, low limit	0...650 Hz	Index 43...Index 45	0
45 [1]	C	Locking freq. 3, high limit	0...650 Hz	Index 44...Index 46	0
46 [1]	d	Locking freq. 4, low limit	0...650 Hz	Index 45...Index 47	0
47 [1]	D	Locking freq. 4, high limit	0...650 Hz	Index 46...65000	0
48 [1]	s	Compensation frequency	0...20 Hz	0...2000	0
49 [1]	zero	Idle current	0...110	0...110 [2]	0
4A [1]	x	Frequency threshold compensation	0.5...30 Hz	50...3000	50

[1] The index is set to its limit if the value range is violated.
[2] With A5 A5, the momentary current is defined as the idle current.

7 Description of individual indexes

7.1 Remark 1: range of ramp times (index 02...05)

All ramp times are defined via two indexes. The range and the time resolution are defined via the ramp code (DAT-H: BIT0 and BIT1). DAT-L contains the actual ramp value. The value is ignored in the event of range violations.

Ramp time in sec.	DAT-H Ramp code	DAT-L Index value
0.05...2.00	0	5...200
02.0...20.0	1	20...200
020...200	2	20...200
40 × 5...200 × 5 (200–1000)	3	40...200

7.2 Remark 2: reduction V/f braking phase (index 09)

A value of 80 corresponds to a reduction of 20%.

Conversion between index value and inverter value:

[8–] = 100–index value

Index value = 100–[8–]

[8–] = reduction V/f braking phase in %.

7.3 Remark 3: configuration of relay and open-collector outputs (index 0F...11)

The indexes 0F to 11 serve to configure the signalling outputs (relay, OC1, OC2). The index is supported as follows:

DAT-H:

0	0	0	0	0	0	0	0
BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0

DAT-L:

0	0	0	OC/Rel	OC/Rel	OC/Rel	OC/Rel	OC/Rel+–
BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0

OC/Rel contains the selection coding (value range: 0...11). The bit field OC/Rel+– contains the associated sign (0 → negative). The value is ignored in the event of range violations.

7.4 Remark 4: activation of external current threshold (index 12)

The current threshold (index 19) can only be read out if this index is set to Rem. The current value is adopted if it is reset to Local. If data is written to this index in the Rem mode, the value is not adopted, but no protocol error is reported (BIT7 of the Contr byte is not set by the slave).

The current Rem value is adopted if it is changed over to Loc.

7.5 Remark 5: motor current limit (index 19)

A limit is set as a percentage of the inverter's rated current. The inverter's response to reaching of this limit can be set. Reaching of the limit can be signalled via the inverter's REL, OC1 and OC2 outputs.

Conversion between index value and inverter value:

$$S[\%] = \frac{\text{Index value}}{255} \times 200$$

$$\text{Index value} = \frac{S[\%] \times 255}{200}$$

S = motor current limit in %.

7.6 Remark 6: current limit hysteresis (index 1A)

The effective hysteresis of the motor current limit when ramp reduction is active is set with this index. This counteracts a tendency of the drive to oscillate.

Conversion between index value and inverter value:

$$HYS[\%] = \frac{\text{Index value} + 1}{2}$$

$$\text{Index value} = (2 \times HYS[\%]) - 1$$

HYS = current limit hysteresis in %.

7.7 Remark 7: rotation direction of fixed frequencies (index 1F)

DAT-H:

0	0	0	0	0	0	0	0
BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0

DAT-L:

0	0	Fix3_V	Fix3_KL	Fix2_V	Fix2_KL	Fix1_V	Fix1_KL
BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0

Fix1...3_V = 1 Clockwise rotation

Fix1...3_V = 0 Counterclockwise rotation

Fix1...3_KL = 1 Rotation depending on the control input (terminal 15)

Fix1...3_KL = 0 Rotation depending on the setting of Fix1...3_V

7.8 Remark 8: setpoint input scaling (index 22)

The reference signal can be scaled via this index. The programmed final values of the output frequency range are reached at the percentage of the final scale values entered by means of Fk.

Conversion between index value and inverter value:

Fk = 100 – Index value

Index value = 100 – Fk

Fk = scaling in %.

7.9 Remark 9a/9b: LEVELS (indexes 29 and 2A)

These indexes serve to configure the digital control inputs.

29 (OffLEVEL)	0 (Remote);	the corresponding function is controlled via the serial interface
	1 (Local);	the corresponding function is controlled via the digital control input (terminal)
2A (ActivLEVEL)	Index 29 = 1;	setting the logic level of the corresponding digital control input (high or low-active)
	Index 29 = 0;	Activates (1) or deactivates (0) the corresponding function via the serial interface

	Description	Index 2A (ActivLEVEL)	Index 29 (OffLEVEL)
BIT7	Terminal 30	0	1
BIT6	Terminal 26	0	1
BIT5	Terminal 25	0	1
BIT4	Terminal 24	0	1
BIT3	Terminal 23	0	1

	Description	Index 2A (ActivLEVEL)	Index 29 (OffLEVEL)
BIT2	Terminal 16	0	1
BIT1	Terminal 15	0	1
BIT0	Terminal 11	0	1

NOTE:

The “active” logic/OffLEVELS are modified, not the ones that can be modified on the keyboard. Therefore, the keyboard values become active again when the inverter is restarted. This avoids inadmissible terminal configurations (e.g. inactive lock) when starting the inverter.

7.10 Remark 10: extended parameterisation (index 2B)

The index 2B (SW1...SW8) is handled as follows:

DAT-L	Description	Range	Default
BIT7	DC brake	ON (1), OFF (0)	1 (ON)
BIT6	Config. of inputs START/STOP and REVERSING	ON (1), OFF (0)	0 (OFF)
BIT5	Config. of error reset	ON (1), OFF (0)	1 (ON)
BIT4	Fmin operation	ON (1), OFF (0)	1 (ON)
BIT3	Config. of error signalling relay	ON (1), OFF (0)	1 (ON)
BIT2	DC brake frequency trigger	ON (1), OFF (0)	0 (OFF)
BIT1	Config. of Autostart function	ON (1), OFF (0)	1 (ON)
BIT0	Activation of “S” ramp	ON (1), OFF (0)	0 (OFF)

NOTE:

The value is ignored in the event of range violations.

7.11 Remark 11: output frequency display (index 2C)

The index 2C serves to query the inverter's output frequency. When data is written to this index, the setpoint frequency is modified (changeover of the setpoint reference to remote operation). The setpoint reference can be reset to the local mode via the CONTROL WORD (index = 3A).

7.12 Remark 12: motor voltage display (index 2D)

MOD 0...255 ACM 230V: 230 / ACM 400V: 245

When the depth of modulation parameter MOD (index 27) is left set to the default, this results is a range of 0...100% for the voltage display. The actual value then covers a range (for 0...100% of the maximum voltage) of 0...230 (230 V unit) or 0...245 (400 V unit).

If the depth of modulation is modified, the result is an index value of 0 to depth of modulation. However, the percentage shown in the inverter display (and thus the voltage in %) always refers to the value specified for the respective inverter (230 V unit: 230/400 V unit: 245). Apart from a certain amount of saturation in the dc link circuit, you can calculated with the following linear formulas:

Conversion between index value and inverter value:

230 V unit: $U[\%] = \frac{\text{Index value}}{230} \times 100$

400 V unit: $U[\%] = \frac{\text{Index value}}{245} \times 100$

U = motor voltage in %.

A depth of modulation that has been set to a value above the default results in percentages above 100.

7.13 Remark 13: motor current display (index 2E)

The motor current is display in the range from 0...200% of the unit's rated current.

Conversion between index value and inverter value:

$I[\%] = \frac{\text{Index value}}{255} \times 200$

$\text{Index value} = \frac{I[\%] \times 255}{200}$

I = motor current in %.

7.14 Remark 14: keyboard & display (indexes 2F...32)

The indexes 2F to 32 serve to remotely control the keyboard via the serial interface and to query the display's content. This permits remote control via the inverter's menu structure. **Write access to this index results in switching over of the keyboard to the remote mode.** Read access switches the keyboard back to the local mode. In the event of range violations, the value is ignored and the keyboard is switched to the local mode. for safety reasons, only the SIO address of the inverter cannot be modified via the indexes 2F to 32. The terminal configuration can also be sent. In this case, BIT0 of the DAT-L byte is set to one. Contrary to what is otherwise generally usual, the response to an inverter error is not an ERROR CODE.

Reply frames depending on the requested index:

INDEX	DAT-H	DAT-L
2F	Digit 1	Digit 2
30	Digit 3	Digit 4
31	Digit 5	Digit 6
32	Digit 7	Digit 8

Remote keyboard operation and terminal configuration are supported as follows:

	DAT-H	DAT-L
BIT7	Terminal 30	SHIFT key
BIT6	Terminal 26	DEC key
BIT5	Terminal 25	INC key
BIT4	Terminal 24	SELECT key
BIT3	Terminal 23	
BIT2	Terminal 16	
BIT1	Terminal 15	
BIT0	Terminal 11	(DAT-H: terminals “No/Yes”)

If BIT0 of the DAT-L byte is a one, the protocol interprets DAT-H as transfer of the “master terminal states”. However, remotely controlled terminal must first be “disconnected” from the inverter's terminal panel with the aid of index 29.

7.15 Remark 15: software version (index 34)

This is a read-only index that provides information about the inverter software in use. DAT-H contains the code for the software type, while DAT-L contains the current software version.

7.16 Remark 16: SIO timeout (index 35)

The timeout serves to intercept uncontrolled inverter states as might be possible in the event of an interruption in the RS485 connection:

If BIT7 in the DAT-L byte is zero, after the timeout has elapsed the inverter is shut down to 0 via the slow down ramp and the states for the display, keyboard, setpoint and terminals are reset to the local mode. “Time Out” appears on the display until the inverter is once again addressed via the serial interface or the device is switched off and then switched on again.

The timeout range is from 0...127, a value of 1...127 corresponding to a timeout of 0.1...12.7 sec. Timeout monitoring is stopped if the value 0 is passed on.

The SIO timeout index also supports shutdown of an RS485 connection. BIT7 in the DAT-L byte must be set. Bits 0...6 in the DAT-L byte (0...127) reflect the timeout time. After the timeout has elapsed, only the states for the display, keyboard, setpoint and terminals are reset to the local mode.

7.17 Remark 17: error code (index 37)

DAT-H contains the error flag, and so it reports occurring errors or faults. It must be reset via the terminals or the terminals controlled with the index 2A.

DAT-H Error flag	
BIT7	Deactivation due to excess current (OVERLOAD)
BIT6	Deactivation due to excess inverter temperature (OVERTEMP)
BIT5	Deactivation due to excess voltage (OVERVOLT)
BIT4	
BIT3	Deactivation due to excess motor temperature (OT_MOTOR)
BIT2	
BIT1	
BIT0	

BIT0...BIT7 = 1	Fatal error (reset only by inverter POWER-UP)

DAT-L contains the warning flag, which informs about pending warnings. There is no need to reset it.

BIT0: 0 = BIT1...BIT7; warning flag
1 = BIT1...BIT3; extended warning flag

DAT-L Warning flag (BIT0 = 0)	
BIT7	Deactivation due to undervoltage (UNDERVOL)
BIT6	Type-specific current limit reached (overload)
BIT5	Undervoltage value briefly reached (undervol)
BIT4	Set current limit reached; ramp stop (RAMP)
BIT3	Set current limit reached; output frequency reduction (HYST)
BIT2	Set current limit reached; inverter stop (ILIMIT)
BIT1	Setpoint line discontinuity or setpoint less than 4mA (I < 4 mA)
BIT0	If BIT0 = 1, see extended warning

DAT-L Extended warning flag (BIT0 = 1)			
BIT3	**BIT2**	**BIT1**	
0	0	0	JOG mode active (JOG)
0	0	1	Dynamic brake active (Dyn Brake)
0	1	0	Limit of software brake protection circuit close (br_limit)
0	1	1	Software brake protection limit exceeded (BR_LIMIT)
1	0	0	Motor potentiometer function: fixed frequency with wrong direction of rotation (MPtFault)
1	0	1	Maximum permitted inverter operating temperature reached (over-temp)
1	1	0	Maximum permitted motor operating temperature reached (ot_motor)
9...127			Reserved

7.18 Remark 18: status word (index 38)

The status word provided information about the inverter's operating state. Only read access to the status word is possible.

DAT-H OUTPORT (Read-Only)	
BIT7	
BIT6	
BIT5	
BIT4	Open-Collector 2
BIT3	Open-Collector 1
BIT2	Relay output (terminals 19, 20)
BIT1	Error signalling relay (terminals 122,123,124)
BIT0	Enabling

DAT-L Control flag (Read-Only)	
BIT7	Direction of rotation (R=1 L=0)
BIT6	Blind version (terminal board with LED monitoring)
BIT5	Reserved for version with optional hardware (additional RAM)
BIT4	Inverter stopped (STOP)
BIT3	DC brake activated (DC STOP)
BIT2	
BIT1	Ramp (BIT 0-1) “11” → rises; “01” → drops
BIT0	Ramp (BIT 0-1) “00” → stopped/reached

7.19 Remark 19: frequency setpoint (index 39)

A write operation to this index results in automatic changeover of the setpoint reference to the remote mode, while a read operation switches to the local mode. The value range is limited at Fmax. A range violation leads to an error message. In this case, the set frequency is limited at Fmax.

7.20 Remark 20: control word (index 3A)

The control word serves to switch the inverter to various device states. However, the majority of inverter control is already covered by the index 2A (LEVELS), which is available for “terminal-oriented” operation of the device. The remaining necessary control actions can be implemented via the control word. The value is ignored in the event of range violations.

DAT-H	
BIT7	
BIT6	
BIT5	
BIT4	
BIT3	
BIT2	
BIT1	
BIT0	

DAT-L	
BIT7	Setpoint Loc (“0”) / Rem (“1”)
BIT6	Keyboard Loc (“0”) / Rem (“1”)
BIT5	Display Loc (“0”) / Rem (“1”)
BIT4	
BIT3	
BIT2	0 = control bits 3...7 can be manipulated 1 = save parameter (control bits 3...7 = 0) 2 = I_LOAD (control bits 3...7 = 0) 3 = I_SAVE (control bits 3...7 = 0) 4 = error + timer reset (control bits 3...7 = 0)
BIT1	
BIT0	

8 Examples

How to handle the BERGES protocol will be demonstrated with reference to a few examples. The inverter with the address 1 is to be addressed. Its maximum frequency ought to be set first to 50.0 Hz. Then specify the inverter setpoint frequency as 30.0 Hz. If the output stages are enabled, the inverter runs on the ramp to 30.0 Hz. The inverter frequency ought to be queried in a further step. Finally, the setpoint reference ought to be reset to the Loc mode. The inverter now once again uses the common ADC value as the setpoint reference.

8.1 Setting the maximum frequency to 50.0 Hz (with slave reply)

Refer to the index list (page 5) for the following line:

Index	Parameter	Description	Inverter value	Index value	Default
00	3	Maximum frequency	6...650 Hz	600...65000	5000

The index for the maximum frequency parameter is 00H. The permissible frequency range here from 6 to 650 Hz corresponds to an index value from 600 to 65000 that is to be sent. This is equivalent to a factor of 100 in the conversion. Therefore, a value of 5000 (1388H) must be sent.

The associated protocol is as follows:

Master (Write/Read)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**01H**	**81H**	**00H**	**13H**	**88H**	**1BH**	**09H**

Master (Write/Read) (Extended BERGES protocol)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
AAH	**01H**	**81H**	**00H**	**13H**	**88H**	**1BH**	**09H**

Slave (reply)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**10H**	**01H**	**00H**	**13H**	**88H**	**8AH**	**2BH**

Slave (reply) (Extended BERGES protocol)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
AAH	**81H**	**01H**	**00H**	**13H**	**88H**	**1BH**	**0AH**

8.2 Setting the frequency setpoint to 30.0 Hz (without slave reply)

Here, the method is the same as when setting the maximum frequency. Refer to the index list (page 5) for details of the value (DAT-H, DAT-L) of the index 39H. To set 30.0 Hz, you must send a value of 3000 (BB8H).

The associated protocol is as follows:

Master (Write-Only)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**01H**	**01H**	**39H**	**0BH**	**B8H**	**8AH**	**2BH**

8.3 Output frequency display

Refer to the index list (page 5) for details of the value (DAT-H, DAT-L) of the index 2CH.

The associated protocol is as follows:

Master (Read-Only)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**01H**	**80H**	**2CH**	**00H**	**00H**	**ADH**	**27H**

Master (Read-Only) (Extended BERGES protocol)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
AAH	**01H**	**80H**	**2CH**	**00H**	**00H**	**ADH**	**27H**

Slave

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**10H**	**00H**	**2CH**	**0BH**	**B8H**	**8FH**	**2DH**

Slave (Extended BERGES protocol)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
AAH	**81H**	**00H**	**2CH**	**0BH**	**B8H**	**1BH**	**0CH**

8.4 Setting the setpoint reference to the Loc mode

The setpoint reference can be set with the CONTROL WORD (see remark 20 on page 14). The index of the control word is 3AH, and the index value (DAT-H, DAT-L) must amount to 00H.

The associated protocol is as follows:

Master (Write/Read)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**01H**	**81H**	**3AH**	**00H**	**00H**	**BAH**	**21H**

Master (Write/Read) (Extended BERGES protocol)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
AAH	**01H**	**81H**	**3AH**	**00H**	**00H**	**BAH**	**21H**

Slave

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**10H**	**01H**	**3AH**	**00H**	**00H**	**2BH**	**03H**

Slave (Extended BERGES protocol)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
AAH	**81H**	**01H**	**3AH**	**00H**	**00H**	**BAH**	**22H**

8.5 Example of a range violation (Fmax set to 655 Hz)

The index for the maximum frequency parameter is 00H. Therefore, the frequency range permissible here from 6 to 650 Hz is exceeded by 5 Hz. Therefore, a value of 65500 (= FFD-CH) must be sent. If the range is violated, in this case the maximum range (650 Hz) must be adopted and the BIT7 must be set in the Contr byte of the slave reply.

The associated protocol is as follows:

Master (Write/Read)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**01H**	**81H**	**00H**	**FFH**	**DCH**	**A3H**	**11H**

Master (Write/Read) (Extended BERGES protocol)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
AAH	**01H**	**81H**	**00H**	**FFH**	**DCH**	**A3H**	**11H**

Slave

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**10H**	**81H**	**00H**	**FDH**	**E8H**	**84H**	**09H**

Range violation Max. limit range (650 Hz – Fmax ACM-D2)

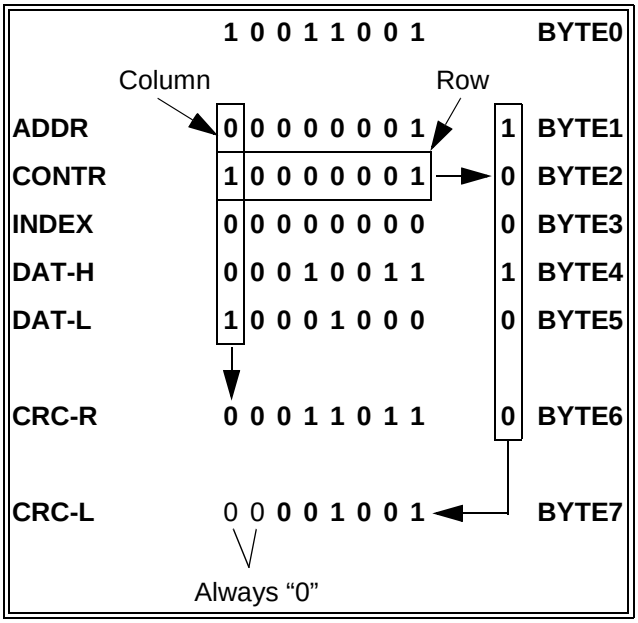
Slave (Extended BERGES protocol)

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
AAH	**81H**	**81H**	**00H**	**FDH**	**E8H**	**15H**	**28H**

Range violation Max. limit range (650 Hz – Fmax ACM-D2)

8.6 Example of CRC calculation

STF	ADDR	CONTR	INDEX	DAT-H	DAT-L	CRC-R	CRC-L
99H	**01H**	**81H**	**00H**	**13H**	**88H**	**1BH**	**09H**
BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5	BYTE6	BYTE7



EVEN parity is always used:

CRC-R: The total number of “1” in a byte and the associated bit in CRC-R must be even; so, if the byte contains an odd number of “1”, the associated bit in CRC-R must be “1”. The bit in CRC-R is equal to “0” if the number of “1” is even.

CRC-L: Must be generated in the same way as CRC-R, but via the rows. CRC-R is always also considered. The first two bits are always “0”.

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